

APPLICATION OF *EUPOS*[®] AND OTHER GNSS SYSTEMS FOR REGIONAL AND INTERREGIONAL PLANNING AND DEVELOPMENT

EUPOS[®] UN CITU GNSS SISTĒMU LIETOŠANA REĢIONĀLAI UN STARPREĢIONĀLAI PLĀNOŠANAI UN ATTĪSTĪBAI

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At the Workshop of INTERREG III C East project “*EUPOS*[®] – interregional co-operation” in Riga, June 9-10, 2007, we were discussing the issues related to application of advanced *EUPOS*[®] technologies used for regional and interregional planning and development. Currently the surveyors are the main users of both the *EUPOS*[®] data and the advanced GNSS surveying and navigation technologies. After this event some additional information was obtained.

What are the regional and interregional issues where the DGNSS could be used? Let us name some of the most important civil application areas of global navigation for these purposes.

- Traffic: train, bus, cargo, all kind of public and private transport (maritime, road, aviation, railroad). Nobody will challenge the importance of traffic use for connection of people in regions and interregional from one country to another.
- EU border line customs related intelligent fleet management. We have the very complicated experience on the Latvian-Russian borderline.
- Accidents, bad weather and road works warning intelligent management systems
- Cargo tracking and tracing throughout the Europe
- Disaster management and emergency (on sea, earth and air – cargo vessels and ferry boats, private yachts and private planes, earthquakes, hurricanes, forest fire, flooding, landslide, etc.)

- Regional territory planning for the sustainable development particularly in East European countries.
- Global and local environment protection
- Cartography, photogrammetry, GIS
- Location based services (LBS)

What are the precision requirements for the mentioned above navigation applications?

Let us estimate for 3 precision ranges used for GNSS applications: 5 – 10 m, 1 – 2 m and cm precision.

For most of the navigation applications precision of 5 – 10 m is good enough. This precision can be achieved by simple and cheap receivers of GPS and/or Galileo in future [1]. The day is already here when you able to use your mobile phone equipped with satellite navigation receiver to find your way when it is needed. The bright future is ahead for this application [1-2].

However, for the many tasks more precise coordinates needed, i.e. 1 – 2 m. The differential GNSS (DGNSS) should be used in this case where a certain number of reference points supplied with continuously operating DGNSS base receivers used. The information of the satellite orbit and clock corrections, ionosphere and troposphere influenced position deviations are transmitted to navigation user by different communication features. Several operational systems are developed by different authors and RTCM corrections supplied by different service providers. This precision has been guaranteed by SAPOS, *EUPOS*®, WAAS, EGNOS, QZSS and MSAS (Japan), IRGNSS (India), by commercial systems Omnistar and FireStar. The integrated EGNOS and Galileo are most promising for the navigation in Pan European space. Very convenient service is right now supplied by EGNOS for the most of applications on road, rail, maritime and aviation navigation. Many handheld GNSS receivers are capable to use the EGNOS correction data distributed from geostationary satellites, as well as available from the proper server by using GPRS media [3-4]. More and more hardware devices developed to use the EGNOS system. European Space Agency (ESA) has several projects under development now [1, 5, and 6].

It is expected that within the Framework Programme 7 (FP7) will be Call devoted to Service Provider's research proposals for the extended use of Galileo and EGNOS in different location based services (LBS) [2].

It is rather difficult to compete with EGNOS in DGNSS applications for precision range 1-2 m. Maybe in Germany where the SAPOS has been used over 10 years the SAPOS DGNSS has been accepted for many transport navigation tasks. However, it is complicated to convince the people in Latvia and in other East European countries on the advantage of *EUPOS*®, [7] against EGNOS for regional and interregional navigation tasks in transport applications where precision requirements 1 – 2 m. Mainly this difficulties raised due to the lack of available cheap navigation receivers and transmission media not acquired yet in our country. We have no any demonstration devices useful for transport navigation which is capable to use

EUPOS® RTCM corrections. Unfortunately, we have nothing more except the Rigas GeoMetr purchased TOPCON rover 20 000 Euros worth. It is too expensive to use the TOPCON receiver instead of the cheap car navigation receiver for transport navigation demonstration. And no one of other invited professionals arrived in this workshop except of surveyors and geodesists from Latvia and Lithuania.

The precision of several cm needed for most accurate navigation tasks (surveying, machine guiding, emergency, mapping). The highest accuracy applied for geodesy and land surveying. There are no competitors for the dense DGNS permanent reference networks in individual countries like the networks ATKOS and SAPOS in Germany or *EUPOS®* in East European countries with common *EUPOS®* and RTCM standards, where the reference stations located at a distances among them of about 50 – 70 km and less. There are very high precision and dense reference networks.

SAPOS system was developed in Germany before year 2000. In most of the East European countries *EUPOS®* activities are started just now or they are at the development and improvement stages in some of them. The LATPOS and *EUPOS®-RIGA* networks are developed in Latvia and about 10 RTK rovers are used for surveying in these systems. LITPOS network in Lithuania is to be installed now. Not still developed in Estonia the *EUPOS®* type system.

We can conclude that currently the *EUPOS®* type system is entering for use in Baltic countries. The land surveyors and geodesists are the only end users. They acquire the system now and they are involved in solution of many tasks mentioned above for regional and interregional development. The maps used for many regional planning activities are produced by surveyors. The projects designed on these bases for regional development. The ready made projects are fixed in nature by surveyors. For example, in Latvia about 100 territorial regions are under development now instead of 526 parishes before. The maps for the planning produced by surveyors. The projects for new region boundaries widely discussed in public. After public disputes the ready made projects examined and analysed at the premises of Ministry of Regional Development. Finally discussed projects are certified by Ministry and then they are useful for realization. As a sequence of these projects a many former agriculture and forestry lands are transformed to the housing areas. New parcels are created and many new living houses designed. Surveyors are the key persons in these processes. The surveying is the only area where the *EUPOS®* type system currently used in Latvia. No persons from the Ministry of Regional Development interested to purchase the 20 000 Euros worth GNSS rover in order to do the field measurements. The other topic urgently needed in Latvia is the high quality National quasy geoid model in order to use it for normal height determination in DGNS measurements. In this sense again we have a great difference with Germany, Netherlands, Austria and other European countries where the dense levelling network developed. It is difficult to understand for our European colleagues the situation of height determination in Latvia. This situation is very difficult in rural areas where the housing districts are developed now but the height reference network is very poor. Therefore the GOCE project developed by ESA is very important for us too [8].

What is the future for *EUPOS®* community?

The future is similar to many other service providers in all around the world. In order to compete with others we have to think on wide range of services, not only the positioning. Location based service information (LBS) about the local situation for the wide spectrum of regional and interregional users for wide range of events where we can use our positioning advantages together with advanced information transmission via broad band communication media and telematics. The co-operation and exchange of experience within the *EUPOS®* community is most important and highly appreciated. The experience of our German colleagues is very important. However, the navigation world and services are changing continuously and we all have to be active in finding the new applications and new service areas.

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Balodis J. Application of *EUPOS®* and other GNSS systems for regional and interregional planning and development. *The current and future application areas of GNSS are discussed at the Workshop of the INTERREG III C East project "EUPOS® – interregional co-operation". What are the regional and interregional issues of GNSS applications, what are precision demands for different application types and which service providers can cope with these demands –these are the topics discussed. The Location Based Services (LBS) predicted as a future development phase-in.*

Balodis J. *EUPOS®* un citu GNSS sistēmu lietošana reģionālai un starpreģionālai plānošanai un attīstībai. *GNSS patreizējās un nākotnes lietošanas vietas apspriestas INTERREG III projekta*

*“**EUPOS®**” – starpreģionālā sadarbība “ semiārā. Kādi ir reģionālie un starpreģionālie GNSS pielietojumi, kādas ir precizitātes prasības dažādiem pielietojumiem un kuri pakalpojumu sniedzēji spēj aptierināt šīs prasības – tie ir apspriestie priekšmeti. Kā nākošā attīstības pakāpe paredzēta Vietas bāzētie pakalpojumi (LBS).*

***Балодис Я. Использование EUPOS® и других систем ГНСС для регионального и межрегионального планирования и развития.** Места современного и будущего использования ГНСС обсуждались на семинаре «Межрегиональное сотрудничество в проекте ИНТЕРРЕГ III – ЭУПОС». Рассматривались вопросы регионального и межрегионального ГНСС требования к точности, кто удовлетворит эти требования. Как следующая ступень развития предусмотрены услуги базированные на конкретных местах.*